

# **The Science and Art of Breastfeeding**

## **Preparing tomorrow's parents to have healthy families**

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June 2006

### **Why Today's Lecture is Important**

- The decision to breastfeed and the process of breastfeeding is a Pre-conception or First Trimester decision in 80-90% of women.
- (Edward Newton, U.Texas, Houston)

### **Course Objectives**

- By the end of this lecture you will know:
- 1) The medical risks of NOT breastfeeding
- 2) The economic costs of not breastfeeding
- 3) The basic science facts of breastfeeding
- 4) Recommendations from the WHO and others for a good start to breastfeeding

### **Risks/Costs of Not Breastfeeding**

### **Formula Feeding vs Breastfeeding**

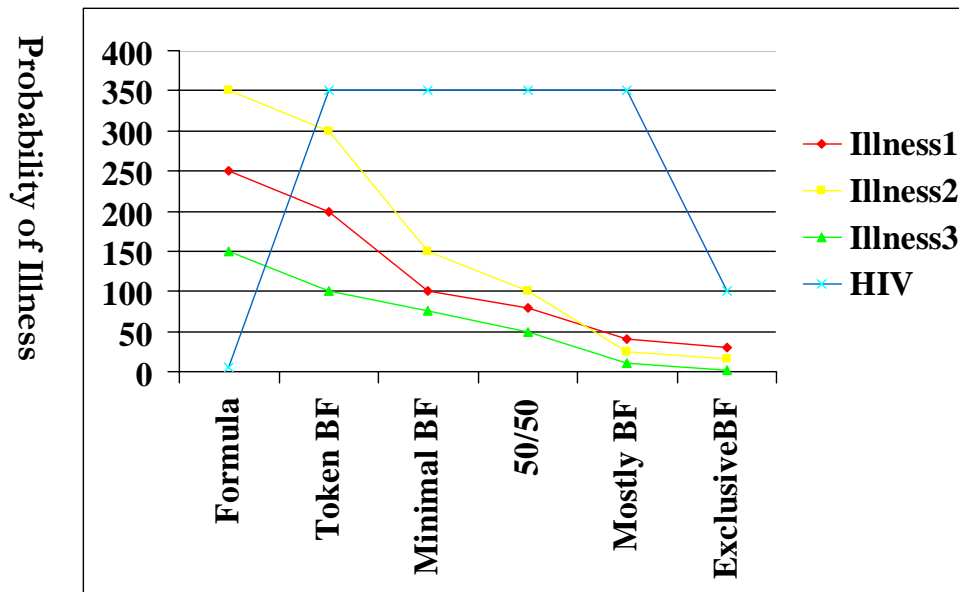
(Increased Relative Risk of Illness in parenthesis)

- Allergies, Eczema (2-7x)
- Urinary Tract Infections (2.6-5.5x)
- Inflammatory bowel disease (1.5-1.9x)
- Diabetes Type I (2.4x)
- Gastroenteritis (3.5-4.9x)
- Hodgkin's Lymphoma (1.8-6.7x)
- Otitis Media (2.4x)
- *Haemophilus influenzae* Meningitis (3.8x)
- Necrotizing Enterocolitis (6-10x)
- Pneumonia/ Lower Respiratory Infection (1.7-5x)
- Respiratory Syncytial Virus (3.9x)
- Sepsis (2.1x)
- Sudden Infant Death Syndrome (2.0x)
- Developed World Hospitalization (3x)
- Developing country Morbidity (50x)
- Developing country Mortality (7.9x)

### **Risks of NOT Breastfeeding**

- Cognitive Development (8.3 LESS IQ Points) Measured at High School in N.Z. controlled SES etc.
- More Maternal Breast and Ovarian Cancer
- More Maternal Osteoporosis
- More Childhood Obesity
- Medical risks in developed countries for up to at least 18 months of age.
- In developing countries risks for even longer.

## Exclusive breastfeeding has much more medical benefit



(Actual curve depends on medical illness considered)

### Medical Costs of not breastfeeding:

Health care costs in an HMO setting >\$1000 in the first year!

- Ball TM, Wright AL. *Pediatrics*.1999;103:870-876.
- 
- Per patient cost difference in WIC=\$478/yr
- This is Medicaid cost per baby
  - (not formula cost)
- *J Am Diet Assoc* 1997;97:379-385.
- Likely MORE now...12-16% increase cost per year=would be over \$2000 per year!!

### Compare to Treating Diabetes:

- The estimated financial benefit of lowering HgbA1C by 1%:
- Between \$685 and \$950 over a 2 year period, or
- \$343 to \$475 per year

### USDA Study 2001:

- A minimum of \$3.6 billion would be saved if breastfeeding were increased from current levels to those recommended by the U.S. Surgeon General (75 initiate and 50 percent at 6 months).
- This is an underestimation because it represents savings from only three childhood illnesses: otitis media, gastroenteritis, and necrotizing enterocolitis.

## **Costs in the Workplace**

- “Rule of thumb” to calculate the cost of lost work from parents caring for sick kids: double it.
- Puts the cost of not breastfeeding to \$7.2 BILLION a year
- Remember, this is an estimate based on only three of the known diseases.
- It is a very conservative estimate for just the USA!
- Considering other diseases... likely in the tens of Billions!

## **Comparative Costs in the USA**

- International Space Station: \$6.3 Billion/year
- 2003: Medical cost of alcohol abuse disorders: \$2 Billion/year
- 2001: Motor vehicle accident health costs: \$17 Billion/year
- US Dept. of Education Discretionary Budget: \$56 Billion/year

## **Other Breastfeeding Advantages**

- Less fertile while breastfeeding.
- More bonding hormones
- Self efficacy/Satisfaction
- 2 am feeding easier
- Baby exposed to more flavors: less picky later.
- More Skin to Skin=less crying
- Less colic
- No bottles to wash
- No extra purchase
- More Convenient
- Nothing extra to carry
- Always Fresh
- Always the right temperature
- Comes in attractive package

## **Weight Loss for Mom**

- During the first year postpartum, lactating women lose an average of 2 kg (4.4lbs) more than non-breastfeeding women.
- No return of weight once weaning occurs.
- (Dewey, KG et al "Maternal weight-loss patterns during prolonged lactation" Am J Clin Nutr 1993; 58:162-166 )
- Decrease cardiovascular disease and diabetes?

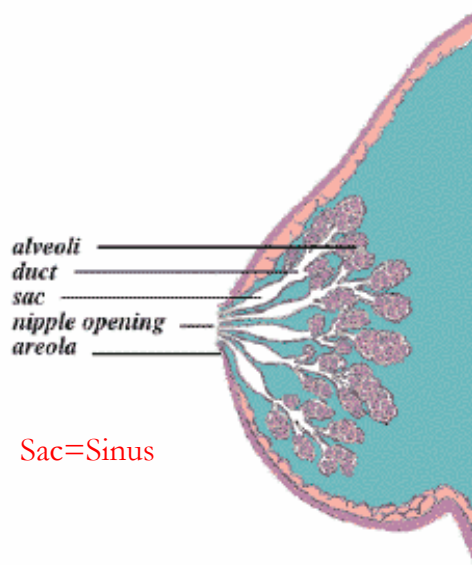
## Costs for One year

- Formula Feeding
  - Cost of 12 Avent Bottles \$43.45
  - \$2000-\$2500 for formula
- Breastfeeding:
  - \$600 more in food for mom in 1 year
  - Bottles, pump, special clothing=optional

## WIC and Free Formula?

- They cover only enough for 5 Kg baby
- 26 ounces per day=Federal limit
- 50% of babies need this by 1 month of age
- Deficit of 3683 ounces=45 cans
- Still have to pay \$720

## Normal Lactating Breast

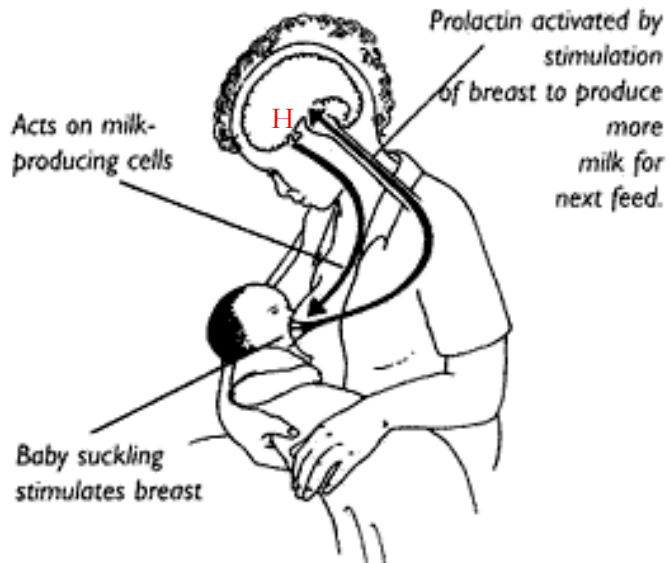


Lactogenesis I: During pregnancy when the breasts are prepared to make colostrum

Lactogenesis II: After delivery when the breasts start to make milk (Usually 3 days later)

Lactogenesis III: Maintenance of Lactation or galactopoiesis

### **Prolactin - makes milk**

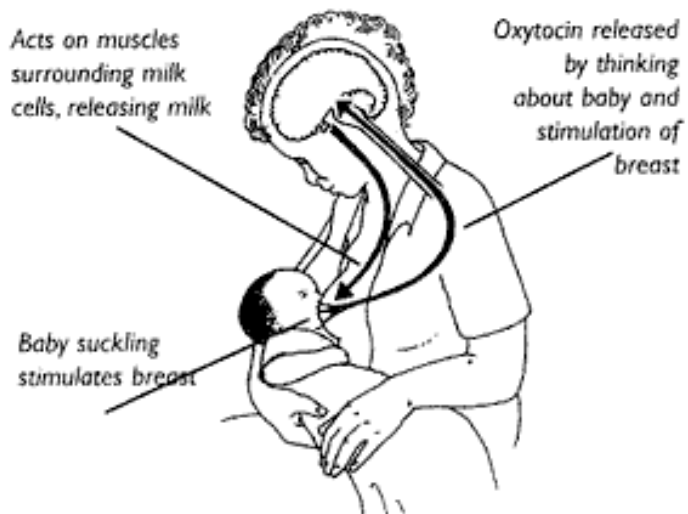


More suckling=  
more milk.

Prolactin increased  
at night

Mediated by:  
Dopamine from  
Hypothalamus:  
Signals Pituitary  
To release  
Prolactin

### **Oxytocin - delivers milk**



More relaxed=  
better letdown

Oxytocin causes:  
Bonding  
Uterus Involution

## **Mechanisms for Defense**

- Antibodies
- Defensive cells (White Blood Cells, WBCs)
- Glycoconjugates: Oligosaccharides, glycolipids, glycoproteins
- Enzymes
- Hormones
- Signal Molecules: Prostaglandin, Interleukin, Interferon
- Vitamins, Minerals

## **Mechanisms for Defense**

- Many as yet undiscovered...(SIDS?...)
- Many items are in higher concentration in milk than in blood!
- Concentrations are mostly highest in colostrum!
- Mostly even higher in premature colostrum vs term colostrum!

### **Maternal Antibodies: Immunoglobulins**

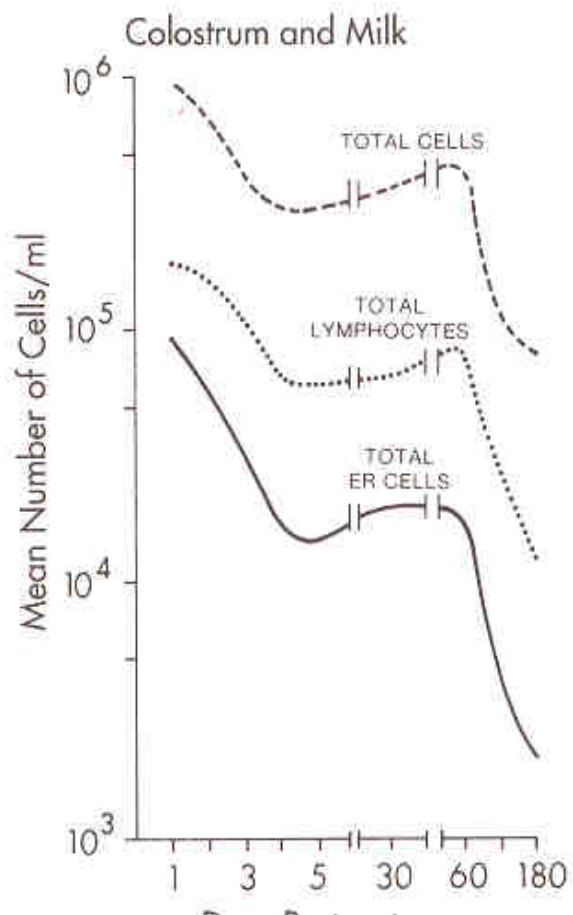
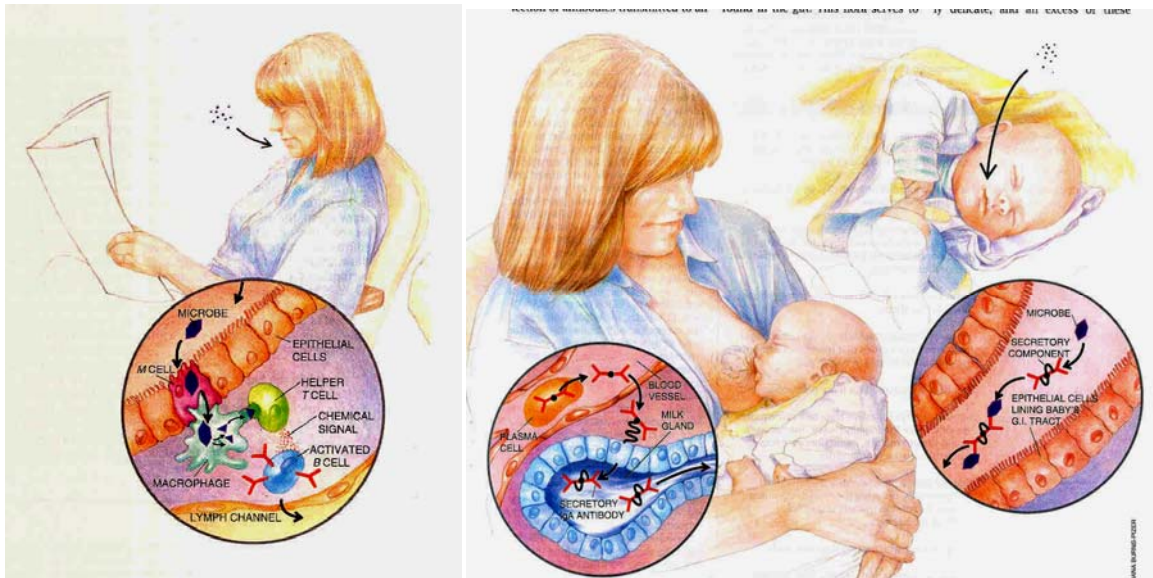
- All classes Immunoglobulins found in milk
- Actively produced by maternal cells in milk
- IgA especially
  - Mucosal Defenses
  - Gastrointestinal Tract (Gastroenteritis)
  - Mouth and Throat (Ear infections)
- IgG, IgM
  - Blood Defenses
  - Promotes phagocytosis

## **Defensive Cells**

- White Blood Cells
- Polymorphonucleocytes (PMNs)
- Macrophages (Largest Population)
- Lymphocytes
- Not Destroyed by stomach acid
- Baby won't have stomach acid for months!
- Survives into intestine and into baby.

### **Defensive Blood Cells**

- 100,000 WBCs per milliliter in colostrum!
- This is 10x higher than blood! (5-10,000 WBC/ml)
- Have different functions in baby than in mom.
- Some evidence to show they incorporate into sucklings' tissues/Lymph nodes!
- Breast fed babies have larger Thymuses than non-breastfed!



ER Cells=Lymphocytes that form Erythrocyte Rosettes on Sheep RBC assay

## **Glycoconjugates**

- Oligosaccharides: Sugar molecules linked together
- Glycoproteins: Proteins with sugars attached
- Glycolipids: Fats with sugars attached
- Mimic Binding sites for pathogens, especially in the intestines.
- This prevents pathogens from penetrating the gut.
- Examples: E. coli, Shigella, Salmonella, Vibrio

## **Enzymes/Proteins**

- Lipase: Digests Fats
- Amylase: Digests Carbohydrates
- Lactoferrin (binds Iron and makes it unavailable to bacteria in the intestines)
- Lysozyme (breaks cell walls of bacteria in the GI tract)
- Insulin
- Bifidus Factor (creates more acidic stool, inhibits growth of harmful bacteria/E.coli)

## **Hormones**

- Thyroid: Sets the metabolism to right level
- Oxytocin: The “Bonding Hormone”
  - Released within Mom during suckling...she bonds
  - Given to baby...baby bonds
- Human Growth Factor: Promotes both growth and proper maturation
- Cholecystokinin: Digestion hormone
- Leptin: Obesity Preventing hormone!
- Dozens more!

## **Fats**

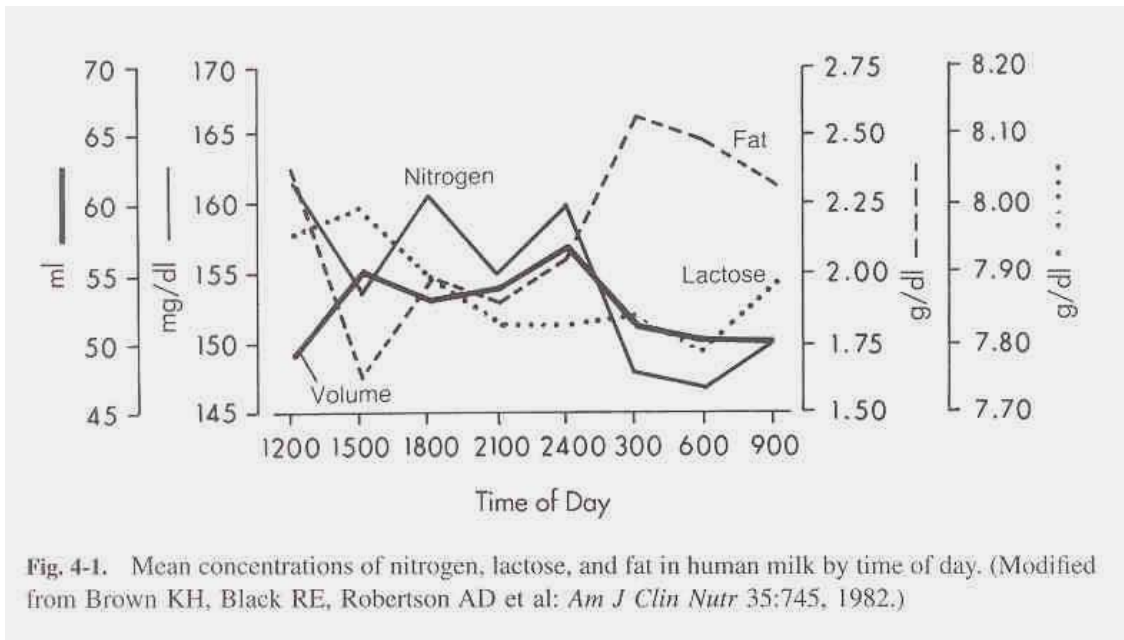
- Polyunsaturated Fatty Acids
- Essential Fatty Acids (Linoleic, Linolenic)
- brain-building omega 3s,
  - DHA (docosahexaenoic acid)
  - Arachadonic Acid
- Unabsorbed fat accounts for unpleasant smelling stools in formula-fed babies.
- Calorie count is somewhat deceptive!

## **Minerals: More to Breastmilk**

- Better absorbed, especially iron, zinc, and calcium
- Iron is 50 to 75 percent absorbed. (Formula=5-10%)
- Contains more selenium (an antioxidant)



## Diurnal variation



### Medical Contraindications:

- AIDS/HIV
- Hepatitis A or B
  - (until Gamma Globulin or HBIG is given)
- Hepatitis C: (Somewhat Controversial)
- Active TB, varicella, or herpes on breast.
- Certain kinds of chemotherapy.

### Other Tidbits

- There is more cream at the end of a feed
  - Thirsty babies eat differently than hungry ones.
- Premature breastmilk is different than and more suitable than term breastmilk or formula for premies.
- Breastfed stool: *Lactobacillus bifidus* = probiotic for immune cells and antibodies.
- Formula fed stool: *Escherichia coli*

### Breastmilk Storage

- Formula goes bad faster at room temperature than breastmilk!
- Frozen Breastmilk is good for 6 months
- Refrigerated Breastmilk is good for 72 hours.
- Stored breastmilk is still much better than formula

### Other Tidbits

- Breast implants or reduction surgery may make it harder to breastfeed
- Piercing, nipple rings or nipple jewelry can cause problems with breastfeeding later.
- You don't have to be double D to have enough milk
- Known for centuries that women can exclusively breastfeed twins (like my wife)
- In 17<sup>th</sup> C France, wet nurses were allowed to nurse up to SIX infants at a time!

### Inducing or Augmenting Lactation

- Galactagogue: Medication given to increase milk supply
- Induction of lactation: causing a woman to lactate even though she didn't just have a baby!
- Therefore: can breastfeed if you adopt!

### Formula Tries...

- DHA or other additives in some formulas: no proof that it works like breastmilk.
- Have to fortify with extra iron because it is less absorbed than breastmilk
- Breast milk is a complex, changing, living thing, and not simply a collection of inert ingredients.
- There are over 100 identifiable ingredients in breastmilk that are not in formula.
- This does NOT include the individualized defense molecules created for the baby by the mom!

## Epidemiology

### Socioeconomic Influence

- **In the USA:** Initiation rates were higher in the highest socioeconomic class (87%)
- Rates are lowest in the lowest socioeconomic class (43%)
- **In Developing Countries:** Rural women and poor women are more likely to breast feed.

### Barriers to Successful Breastfeeding. WIC data.

- Lack of confidence (Starving Baby).
- Perception that Formula=Breastmilk.
- Loss of Freedom.
- Embarrassment.
- Jealousy (paternal and sibling).
- Going back to work or school.
- Physical Discomfort.
- Fear of difficulty in weaning when desired.

## **Healthy People 2010 goals:**

<http://www.health.gov/healthypeople/Default.htm>

- Department of Health and Human Services and the Public Health Service establish goals every 10 years.
- Goal 75% of women will Initiate breastfeeding.
- Goal: 50% of women will breastfeed to six months.
- Goal: 25% of women will breastfeed to one Year.

## **Psychological Impact of Breastfeeding**

### **Bonding:**

- Human mothers who are separated from children who are sick known to lose interest
- True of animal species
- Infants separated from their mothers cry 10x more than those together with their mom.
- It is very difficult to do a study that separates out breastfeeding from bonding.
- There is still debate on this topic.
- Skin to skin contact important regardless

### **Examples of difficulty with studies:**

- 1) Study showed bottle feeding moms had more anxiety, stress, depression, regression, fatigue, and guilt.
  - How can you say that these traits didn't just predispose the mom's not to breastfeed?
- 2) Mothers watching videos of their baby. Breastfeeding moms were more relaxed, wanted to interact more with the child, and expressed greater satisfaction with breastfeeding.
  - Maybe moms with these characteristics were more likely to breastfeed!

### **Bonding Bottom Line:**

- TRUE: multiple studies show increased bonding in mothers and babies who breastfeed than those who do not.
- **There still remains the question:**
- Do women and babies who tend to bond less breastfeed less?
- Or do those who breastfeed less bond less?

### **Early and Often Skin to Skin Contact: Proven Benefits**

- Mothers nurse 50% longer than those without that contact.
- More exclusive breastfeeding
- Babies cry less
- Better emotional bonding response
- Decreased child abuse

### **Automatic Breast Seeker**

- Studies show normal baby will go to breast without help from anyone.
- Just leave baby skin to skin on mom...
- 45 minutes later: breastfeeding!
- Study showed that if you wash one breast, the baby will go to the unwashed breast!

### **Imprinting**

- Mammals and humans are known to imprint
- Oral-tactile stimuli are known to be the most important to human babies.
- Known that infants given bottles or pacifiers in the first 2 to 4 weeks of life are more likely to have a dysfunctional suck pattern and breastfeeding problems.
- Known that infants children who thumb suck more are more likely to have breastfeeding problems.
- Margaret Mead reports no thumb sucking in societies where frequent and unlimited suckling is accepted.

### **Oxytocin:**

#### **More Bonding, Less Stress**

- Decreases blood pressure.
- Calms the mother.
- 38-fold difference in the frequency of domestic violence and sexual abuse was found between the group that breastfed and the group which did not. (Acheson 1995)
- Lactation decreases ACTH, Cortisol and Epinephrine compared to non-lactation.

#### **More Stress, Less Let Down**

- Stress, loud noises, etc. known to decrease oxytocin.
- This has been shown to decrease the "let-down" reflex.
- Cultural interpretation: there are several cultures that believe that the QUALITY of milk is effected by emotional upset...this is FALSE.
- It is true that milk won't come out as easily if mom is stressed!

### **Baby-Friendly Hospital Initiative (BFHI)**

- A global program sponsored by the World Health Organization (WHO)
- And the United Nations Children's Fund (UNICEF)
- To encourage and recognize hospitals and birthing centers that offer an optimal level of care for lactation
- Ten Steps are based on solid scientific evidence.
- American Academy of Pediatrics: support
- These ten recommendations are what should happen in hospitals.
- We know that if the mom's continue for the first two to four weeks of life that there are better outcomes.
- We know that hospitals that are certified as BFHI have better breastfeeding outcomes

## **BFHI Ten Steps**

- 1 - Maintain a written breastfeeding policy that is routinely communicated to all health care staff.
- 2 - Train all health care staff in skills necessary to implement this policy.
- 3 - Inform all pregnant women about the benefits and management of breastfeeding.
- 4 - Help mothers initiate breastfeeding within one hour of birth.
- 5 - Show mothers how to breastfeed and how to maintain lactation, even if they are separated from their infants.
- 6 - Give infants no food or drink other than breastmilk, unless medically indicated.
- 7 - Practice “rooming in” -- allow mothers and infants to remain together 24 hours a day.
- 8 - Encourage unrestricted breastfeeding.
- 9 - Give no pacifiers or artificial nipples to breastfeeding infants.
- 10 - Foster the establishment of breastfeeding support groups and refer mothers to them on discharge from the hospital or clinic

## **BFHI Ten Steps**

- These are proven to help on a population wide basis.
- It doesn't mean that an individual won't do well if they don't do the same.
- I believe these same principles should be taught to all prospective mothers and their families.

### **Normal Breastfed Newborn**

- ❖ Normal babies are replete with fluid at birth.
- ❖ They lose weight in the first few days
- ❖ Colostrum is taken 8-12x per 24hrs: 5 cc at a time is common, 30cc possible
- ❖ Mother's milk “comes in” at day 3 of life.
- ❖ Baby then begins to regain weight.

## **Signs Baby is Getting Enough:**

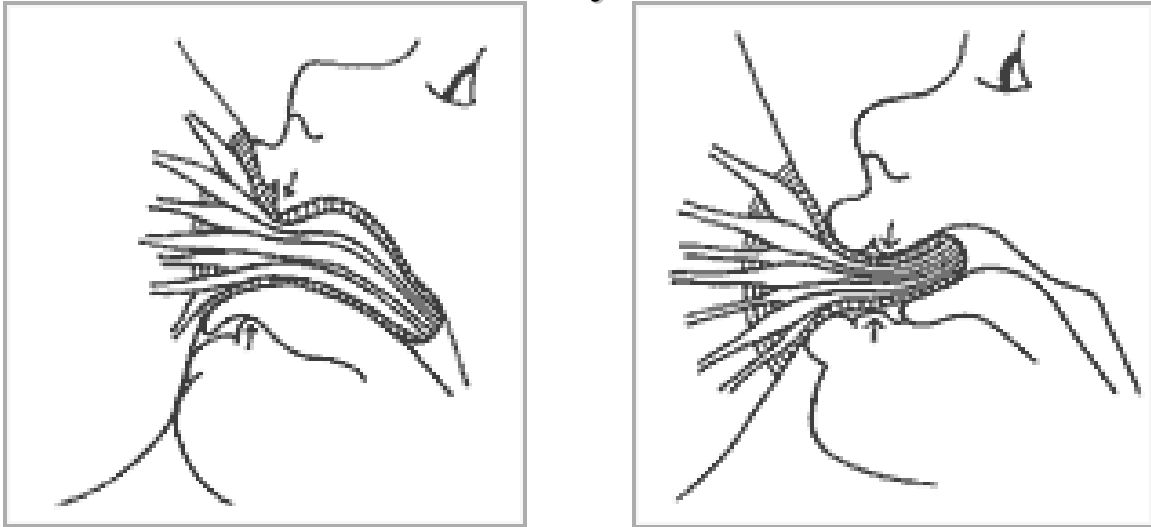
- Hear swallowing at the breast
- Baby satisfied
- Diapers: 1 by day 1, 2 by day 2, 3x3, 4x4, 5x5, then 6 or more per day after day 6.
- Poopy diapers: at least 3 or more after milk comes in.
- Weight loss is less than 8% of birth weight.
- Regain birth weight by 2 weeks of age.
- Follow BFHI recommendations.

### **AAP Recommends:**

#### **(American Academy of Pediatrics)**

- Baby seen by the doctor at 3 to 5 days of life and again at 2 to 3 weeks of life.
- Baby should be given Vitamin D 200 I.U. starting at 2 months of age.

## Milk Sinuses: Latch is the Key!



### WHO Recommends (World Health Organization)

- Exclusive Breastfeeding until 6 months.
- Delay introduction of solids until 6 months
- Breastfeed to 2 years or more if possible.  
**Utah Code Ann. § 10-8-41, § 10-8-50, § 17-15-25, § 76-9-702, § 76-10-1229.5,**
- Added by Acts 2003, 78th Leg., ch. 1274, § 3, eff. April 1, 2005.
- Utah enacted legislation clarifying a woman's right to breastfeed in public, even if there was some exposure of the breast.
- It exempts breastfeeding from indecent exposure statutes.

### Telephone Numbers

- Utah Coalition to Promote Breastfeeding: 1(800)662-3638
- Intermountain Breast Feeding Center at PCMC: (801) 588-3893
- La Leche League: (801) 264-5683
- Pregnancy Risk Hotline (UofU) (801) 328-2229

### National Telephone Numbers

- AAP Breastfeeding Promotion in Pediatric Office Practices program
  - Tel# (847) 228-5005, ext 4779
- La Leche League: 1-800-LaLeche
- Human Milk Banking Association of North America: Tel# (888)232-8809
- International Lactation Consultants Association Tel# (919) 787-5181

## Websites

- New York State Curriculum (Grade by Grade)
- <http://www.health.state.ny.us/community/pregnancy/breastfeeding/main.htm>
- Costs of not breastfeeding:
- <http://www.ers.usda.gov/publications/fanrr13/fanrr13.pdf>
- BFHI: <http://www.babyfriendlyusa.org>
- American Academy of Pediatrics (AAP) Policy Statement:
- <http://aappolicy.aappublications.org/cgi/content/full/pediatrics;115/2/496>

## References

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- Riordan J. Breast feeding and human lactation. 2nd ed. Sudbury (MA): Jones and Bartlett, 1999
- Moreland JC, Coombs J. Promoting and supporting breastfeeding. *American Family Physician*. 2000;61:2093-100,2103-4.